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Improving Learning Capabilities: A Case Study of an *Independent Research Unit* in Interaction with the Local Community

Casten von Otter

The focus of this study is on interaction between local public administration, businesses and universities in a Triple Helix. The paper presents experiences from an independent research organization set up to further regional development, where doctoral students worked with a local community. The paper also draws on experience from other similar independent research units in Sweden. It is suggested that a major reason for the lack of rapport between the parties is that researchers and entrepreneurs tend to stress different parts of the research process. While orthodox science emphasizes verification, entrepreneurs are more interested in theoretically informed creativity and innovation, especially when they gain from saving time. They see uncertainty and risk management as unavoidable components of doing business, and often mistrust scientific proofs and abstract modelling.

Key words: regional development, Triple Helix, interactive research, innovation systems, organization of PhD studies, Mode 2

Background

The Independent Research Unit (IRU) is a new arrangement for regional interactive research, to support the capitalisation of knowledge for the benefit of the community. Many PhD students appreciate a more interactive and so-

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cially-dynamic setting for their studies, and it is suggested that an IRU can offer an important alternative to campus-based studies, as well as an option for academic institutions that want to increase their potential as entrepreneurial and R&D oriented. To do this, however, we also need to base the work on an improved understanding of how new knowledge is received and examined before it is applied by people in business.

The paper examines a regional research unit (forskarstation) manned by doctoral students in Norrbotten, Sweden. The experience of Forskarstation Östra Norrbotten (FÖN) is summarized, and suggestions are made concerning strengths and weaknesses based on five years of experience[1] .The institutional concept of IRU is a response to the transgressive tendencies in society today with science and society invading each other's domains (Nowotny/ Scott/Gibbons 2001). The discussion is related to the Triple Helix (Leydesdorff 2005; Etzkowitz 2003; Viale/Rosseli undated), to regional innovation systems (Johnson/Edquist/Lundvall 2003), interactive research (Aagard Nielsen/Svensson 2006) and Mode-2 research (Nowotny et al. 2001). It is suggested that the discussion over interactive research can bear on several problems which have surfaced in FÖN and IRUs in general, in relation to research strategy, interaction and the development of new learning capabilities among SMEs or a local community.

Compared to several other analyses of the Triple Helix framework, this article puts more stress on the epistemology of innovations as well as research strategies, which need to reflect the different roles of the parties in the tripartite structure. Government, business and academia all have numerous interests in research, some of which might conflict.

The case

Four small municipalities (in all 40 000 inhabitants), situated above the Arctic Circle, formed FÖN as part of a strategy to combat a depressed economic

[1] Experience has been gained at Forskarstation Bergslagen, Forskarstation Söderhamn and, now, Forskarstation Östra Norrbotten (FÖN), as well as at some successful spin-offs from these, APeL, a R&D centre for vocational training (in Lindesberg), and Formens Hus i Hällefors a centre for industrial design. (Svensson/von Otter 2002).

situation and meet the new challenges posed by the knowledge-based economy for peripheral communities. They settled on an IRU as it promised the best synergies for the different purposes of the parties concerned. Some were highly instrumental – expecting R&D findings that would lead XX to straight tonew businesses, others were more indirectly so – hoping the presence of researchers would invigorate old discussions. Some wanted to develop tourism, while others wanted to commercialize the regions' natural resources more effectively. An IRU was eventually selected because it was perceived as a relevant, flexible and, at the time, new concept that was worth testing[2]. Following several similar projects, it is now becoming possible to gather experience of these organisations. While quite successful in achieving many of their aims in terms of networking and opening up academic environments to applied research, they have been only moderately so in achieving the expected kind of innovative relationship with engaged businesses. The article will describe the case of an IRU in some detail and then turn to a discussion of the difference in epistemological needs with regard to innovations between the theorist and the practitioner.

What is an "independent research unit"?

An IRU is an independent unit for research established outside universities. It is an attempt to bring academic studies closer to a community which it can serve, inspired by concepts of modern regional development theory. The pillars of the IRU Helix are politicians, business leaders and doctoral students (supported by their supervisors). Collaboration with one or several university institutions is established to meet the requirements for a PhD programme and, of course, to get access to the academic, intellectual and material resources of the university and the discipline's own research quality control.

Traditional graduate studies are a poorly exploited resource in terms of time and capacity, seen in the perspective of the "entrepreneurial university" (Etzkowitz 1998). A PhD programme runs for four to five years in Sweden.

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[2] My role was as an advisor and member of a process-reflection team. I was invited as I had experience from the first IRU, which was established in 1996 in the central region of Bergslagen (von Otter/Svensson 1997; Svensson/von Otter 2002).

The traditional setting (*Mode* 1 in Nowotny et al.'s distinction 2001) is within a department and the topic of the thesis is mostly chosen within the established discourse of the discipline and the research interests of the supervisor. To many students, the setting is narrow and not dynamic, with too few inputs from the outside world. Increasingly, prospective employers complain that an educational career to the highest academic level under these circumstances is suboptimal to their needs. The doctoral students are socialized into a culture which sets itself too much apart from what is expected in industry and applied research. An external research unit can in this connection be an attractive alternative, drawing on the motivation inherent in social interaction and feed-back from application. In addition, the new partnership allows academia and engaged business corporations to pool intellectual and material resources. Universities have had positive experience with internal entrepreneurial graduate schools, a model which is encouraged by public research funds, (Arnold et al. 2004). Distinguishing features of an external and independent school are:

– The activities are independent of the university and localized at a distance outside campus, but there is close co-operation with SMEs and with academic institutions. The students have a double affiliation, to the university and to the IRU.

– The aim is to establish favourable preconditions for communication between applied and academic activities, especially within the various research projects.

– The IRU has independent funding for the students and varying amounts to cover additional costs, mostly from the EU and local public resources.

– Government of the IRU reflects the Triple Helix. A framework agreement is negotiated between the parties which assigns some discretionary powers to a steering committee, while the university retains full responsibility for the academic side of the studies.

– The period of practical work, that forms a part of all graduate studies, is served at the IRU. This involves organising seminars and external activities for the local community. The main aim is to establish a new knowl-

edge process in the relationship between companies and researchers. The IRU's objectives are related to the regional or local innovation system. The research strategy and methodology, which initially was relatively loose, has with increasing experience gradually absorbed ideas of Mode-2 and interactive research.

The initiative for IRUs has come from any one of the parties, but is always based on a negotiated agreement by the Triple Helix. The IRU is especially relevant for economically-marginalized regions on which universities usually turn their back, arguing that research resources for efficiency reasons need to be concentrated. The regions on the geographic periphery see improved research presence as a top priority. Both sides are probably right, having different marginal utility function. The IRU is an attempt to service both.

The first external research school in Sweden was the one established by Forskarstation Bergslagen. This was a project that involved the National Institute for Working Life (ALI), and eleven municipalities and was funded by the municipalities and the EU's Structural Fund (Svensson/von Otter 2002). A graduate school that offered 10 doctoral studentships was established in collaboration with two universities. A few years later, ALI established an IRU with eight students in Söderhamn, another area impoverished by structural change in industry.

The first IRU was set up by researchers uncomfortable with the traditional academic format, wanting to test ideas of interactive and applied research. They managed to get a grant from the EU Structural Fund and organize a network of eleven municipalities in Bergslagen. The main resource was the interdisciplinary doctoral studies programme established with two local universities (Karlstad and Örebro). Each of the ten students was linked to a "project consultant", a local person who had relevant practical experience. Another feature was the systematic attempt to establish links outside the region and to make the IRU a *glocal institution*. Interactive research was a vehicle to establish a tight relationship with the business community. However, many of the doctoral projects were traditional in chosen scientific approach at this stage, due to opposition from the universities towards what they understood to be action research.

The IRU in Söderhamn was modelled on the one in Bergslagen, though only one municipality was involved. An important development was the effort invested in a participatory process by which the research portfolio was settled (Forskarstation Söderhamn 2007).

FÖN, the case at the centre of attention in this article, was different in origin. It was initiated by community leaders in Norrbotten after a study trip to Bergslagen. They discussed possibilities with the nearest universities (250 km and 500 km away). The students who were engaged and their supervisors were not necessarily interested in regional development or an interactive twist to their research. At least some confessed, *ex post*, that the main attraction was the opportunity for funding, or to get access to a field site for traditional research.

The "R no D" paradox.

In modern growth theory, the knowledge factor is regarded as being more central than capital accumulation, which has turned the spotlight on the national S&T (Science & Technology) policy. This has generated an intensive debate and much soul-searching among the players concerned. The discussion has encompassed institutional, organizational and epistemological issues. The IRU has launched also an institutional variation in this discussion.

Academia. The increased importance of knowledge, and the role of the university in incubating new firms or business proposals, have made institutional interaction an important theme in the evolution of innovative academic environments. The entrepreneurial R&D institution takes a proactive stance in putting knowledge to use and in widening the input into the academic community. Thus it operates according to an interactive rather than a linear model of innovation. As firms raise their technological level, they move closer to an academic model, engaging in higher levels of training and in the sharing of knowledge (Etzkowitz 2003).

The importance of the issue relates to the internationally-observed phenomenon that R&D investments in certain highly-developed countries, including Sweden, are not providing such a high economic yield as they are in other leading countries, notably the USA (Edquist/McKelvey 1998). World

class R&D expenditures and academic publications do not translate into equally strong high tech commercial innovations. A number of issues have been debated: Does the fault lie with the universities, the academic environment, the distribution of resources or the way that research is governed and controlled? A conclusion many policy-makers have reached is that the universities need to break with the sluggish structure of traditions and cultures that are manifested in disciplines, professional organisations and journals that regard the disciplinary discourse as their preserve.

The Swedish university system is deeply anchored in the Humboldt doctrine which is sceptical of any close collaboration with commercial forces, as well as to politically-expressed research needs. Surveys have shown that the Swedish academic world is characterised by uncertainty and weak incentives with regard to interaction with business and industry. The strongly empirical intellectual tradition also tends to reject action research and constructivist theories in general (Sörlin/Törnqvist 2000; Brulin 2002). Mode-2 theorizing does occur, but has led to few experiments with radically new institutional arrangements, and is a marginal feature within Swedish universities.

Government. R&D and S&T policies have increasingly focused on university-industry-government interactions. An observation from the research policy discussion is the difficulty to establish positive effects from projects aiming at structural change. According to ITPS (Swedish Institute for Growth Policy Studies), the total investment of EUR 1.8 billion in 7 000 EU projects in Sweden had no measurable impact on the gross regional product (ITPS 2004). The institute points out the expectations that these programmes will have major regional impacts are unrealistic, but that projects can be meaningful in other ways.

Even in intellectually highly-dynamic environments, most of the knowledge comes from outside. Industrial research policy should therefore aim for more openness, rather than for tight local industrial clusters. The task is general in nature; to ensure that the system is open to the inflow of knowledge, people and capital. ITPS concludes: Efforts should focus on creating regional development capacity, instead of on trying to achieve direct changes in the regional economy. Projects of the type funded by the Structural Funds (EU) should primarily aim to improve “development-dynamic organisation” in the

region. Committed and enthusiastic entrepreneurs are the most important success factor with regard to innovations.

S&T policy-makers know remarkably little about how the transformation of knowledge into productive force actually takes place (Ekstedt 2001). Economists are generally satisfied to note that companies and society should invest in R&D, education and lifelong learning, but the relationship between knowledge, practice and action is mostly kept encapsulated in a *black box* – not seen, nor spoken much of (Aagaard Nielsen/Svensson 2006).

Business. In the theory on innovation systems, innovation factors are widely defined as: "All the important economic, social, political, organisational, institutional and other factors that influence how innovations arise, are distributed and used" (Edquist 2001). The management consultant Gary Hamel likes to stress that concepts such as human resource management, accounting and self-managed groups – not forgetting life-long learning – contribute more to the sustainable competitiveness of a company than any patent. Innovation systems are thus not only about traditional inventions, they also relate to the innovative renewal of everything relevant to the business.

Innovation does mostly not occur in a linear process: *problem – research – solution – new jobs*. This model may work if a company has a suitable, well-defined problem relating to a specific issue. However, in such situations there is usually a greater need for support from consultants, training or simply help to find information, rather than support from researchers. It is more typical that applicable results arise from an interactive and reflective learning process (Argyris/Schön 1974; Nowotny et al. 2001).

The core of national and regional innovation systems consists of R&D institutions in a broad sense, but the most important sources of new ideas and knowledge for SMEs are customers and competitors and other elements of their commercial network. The company's everyday relations with its personnel, customers, suppliers and consultants comprise important components of the innovation system, as do knowledgeable media that critically examine new developments and disseminate information on good examples. For the average company, learning is about assimilating and using the best of the knowledge and know-how that is already available, and not about pursuing new knowledge on the frontline of research. Thus, workplace innovation is

closely linked to regional development through "low-intensity changes", generated by a variety of actors and dynamic situations (Fricke/Totterdill 2004). This process can be facilitated by supportive research, for which IRUs seem to be an ideal arrangement.

The IRU fits into this discourse as a micro-level institution based on a Mode-2 apprehension of communication, learning and innovation, and has gradually developed a more conscious theoretical base.

"Forskarstation Östra Norrbotten" (FÖN)

FÖN was established in 2001 and funded by the EU, and lasted until 2007. The steering group formed by the four municipalities[3] approached Luleå Technical University (LTU) and the branch at Umeå of the Swedish University of Agricultural Sciences (SLU). After a process inspired by the Triple Helix model, seven themes were chosen for doctoral students:

- Tourism (two students)
- Internet and e-commerce in tourism
- Industrial design and wood manufacturing
- Cultivation of perch
- Domestication of species of Vaccinium (blueberries)
- (Evaluation of the programme, using network theory).

The doctoral students were recruited by different university departments and assigned thesis supervisors. Doctoral students normally appropriate 20 percent of their time to department work, tutoring students etc. Here the students were expected to work with businesses and agencies in the region – giving seminars, consulting, talking to high school students etc. – as well as doing their field work in the region. In the final year, the group went "on tour", informing and propagating amongst the community and schools about R&D. Two special courses were held for the group (and other graduate students).

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[3] The four are Haparanda, Kalix, Överkalix and Övertorneå municipalities

FÖN had an administrative and a research coordinator – the latter only in a small part-time post. The administrator acted in an executive position.

There was no common explicit research strategy. However, as problems in the relationship with the business community, and to a degree with politicians, became explicit, the issue of interactive research surfaced. One can reflect that the steering committee had not done its homework properly, with little learning from relevant research at the outset. However, it is more important that the process has allowed for learning, readjustment of behaviour and a move to a new level of consciousness.

Given this background, I focused my process-evaluation report (on which this paper is based¸ von Otter 2007) on three questions:

– To what extent has FÖN achieved its concrete objectives; collaboration, the development of the companies and good research?

– Has FÖN stimulated meta-learning from good and bad results (double-loop learning) with regard to the organisation (the Triple Helix) and the interactive processes and the theoretical foundation of the project?

– What conclusions are there for new initiatives with a similar objective?

The next section is based on four empirical sources: first, the ongoing presentation of the activities at FÖN's seminars, study visits and so on (FÖN 2007); second, a study based on network theory by a doctoral student (Sandström 2004, 2007); third, a survey designed by myself for both universities, and finally an assessment of the thesis publications. It can be noted that the view of what has been successful, and what has been problematic in relation to the objectives, is rather uniform, and not over-stated, and therefore hardly empirically controversial. What I add is primarily interpretations and comments informed by theory.

Evidence and observations

The account of the FÖN experience is mainly focused on the academic participants. A survey was administered to students, thesis supervisors and department chairs, concerning their experience of collaborating with FÖN. The

survey was a total-population survey[4]**.** The views of other stakeholders in the concluding section are based on Sandström (2007)**.**

Comments on FÖN's successes, as examples of the perceptions that characterise most interviews at both campuses, are e.g.:

– The research projects have been implemented on the initiative of, and in interaction with, local players in a sparsely-populated rural area.

– An arena which did not exist before has now been created for communication and direct dialogue between the municipalities and the university.

– The educational quality of the doctoral programme and of the thesis is judged to be high.

– The application orientation has a positive intrinsic value in the educational programme.

A supervisor summed up his impressions as follows: "It would be a great shame if the project was not allowed to continue. /…/ To be honest, I am proud, pleased and delighted to have been involved in the project. It has been extremely stimulating." No one stated that the special educational situation had a negative effect on the studies. However, although the doctoral students appreciated the practical context, several complained that it was demanding and sometimes led to conflict when company representatives or politicians expected more than the students were able to deliver. Then again, the students acknowledge the value of close interaction with politicians and companies for their post-doc careers. Among positive effects respondents mentioned that FÖN helped to clarify academic demands e.g. regarding the interaction between theory and practice, to the companies and municipalities. FÖN also in some cases strengthened the internal collaboration between the university departments, the supervisors and/or the doctoral students, and stirred things up in a positive way in the planning of their research and education. A concrete result of the collaboration was that LTU introduced a new research area (tourism), reversing a previous decision not to invest in this field.

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[4] All of the survey material is publicly available as working material from FÖN.

One of the central aims of the project was for the university to acquire a deeper understanding of the activities of the commercial, industrial and municipal sectors. Most of the respondents feel that a good new form of organisation has been established for wide-ranging collaboration between four municipalities, the business community in these municipalities and two universities. New knowledge has been acquired, although this is limited to the few companies that participated directly in the project.

Do the respondents feel that FÖN was a good way for the university to accomplish "the third mission of the university", that is the obligation to interact with the community? The view is generally positive, but many problems are also mentioned. Most of the respondents felt that this link is very important and that the university often failed in this mission. "There is no clear link between the community and the university. I believe in ideas like this, but FÖN's resources are too limited to have any major impact" (a supervisor). There were also optimistic comments about the importance of FÖN, like the following:

> "Absolutely, I don't know of any example where it has worked better. It has been a mutual collaboration. Neither of the parties took up an entrenched position, which can sometimes happen." (Doctoral student)

Several respondents point out, however, that the companies misunderstood the role of the doctoral students. The companies found it difficult to understand that research often takes time. Some of them did not recognize the distinction between the type of knowledge of a researcher and the knowledge of a consultant or recall the difference between the consultant who can provide quick answers and solutions, and a researcher's work which often only results in new and even more difficult questions.

Some of the comments from the researchers clearly show that even they did not all understand or accept the essence of an interactive approach which tries to over-come differences. One example from a senior researcher: "We managed to keep the roles separate. The university handled research issues, while the companies were supplied with the results." Others commented on the same aspect differently: "Integration between the university and the companies was too superficial for a true exchange". A positive result of the collaboration was that understanding increased over time. The Mode 2 approach

assumes that the transgressive process is ongoing; it is not a choice for either party to make, but a factor to which they need to adapt.

Another rather important aspect that is highlighted is that the collaboration was good for the university's public relations. The subjects of the theses attracted media attention, which is not insignificant in a region with a wide gap between academia and the community in general. The projects reached the attention of the public. "People knew who I was when I introduced myself," said one doctoral student. She felt that she got her results across. "Research is often only published in scientific journals, but here it came directly to the attention of people in the region. I felt that people listened and had a use for my results as the right channels for this were in place. I believe that this is unusual and it is one of the main advantages of the project".

Almost everyone, on the other hand, was critical of the shattering into too many different disciplines and topics. The subjects of several of the theses bore no relation to any of the other theses. The three members of the tourist group, however, benefited greatly from each other. Over the years, the ambition to support the development of the region gathered more and more backing among the doctoral students and their supervisors. The ambition was there, but collaboration proved to be more difficult than many had expected. This made some of the researchers interested in interactive methods.

The final questions in the survey covered FÖN's successes and failures. In Table 1, the answers of all the respondents have been distributed per eight themes. The un-bracketed figures relate to all respondents, while the figures in brackets apply to the doctoral students alone.

The high ambitions with regard to collaboration between the university and the business community is perceived as the most unique and positive factor, despite the fact that the respondents also see many shortcomings in this respect. Many of them appreciate the interaction with the Helix parties in the different phases of the projects, which is reflected in specific comments on the quality of the research (good thesis) and of the educational programme (useful experience). The negative comments on the organisation and the educational programme are not of the same general nature but relate to individual events. As far as the criticism is concerned, it can be noted that it raises important issues but that it should also be possible to deal with them. An alter-

native conclusion may of course be that the positive assessments relate to a great degree to intentions, while the criticism concerns concrete things that have happened/failed to happen.

Table 1: Name three areas where you think FÖN was successful/less successful

Theme	Positive	Negative
Collaboration university –companies	12 (2)	4 (1)
Administrative organisation	8 (2)	6 (1)
The public image of the university	7 (3)	1 (1)
Educational quality	6 (4)	6 (3)
Concrete (practical) results	4 (2)	2
Research quality	3 (1)	0
Choice of thesis subjects	1	6 (4)
Continuity following FÖN I	0	6 (1)

N=19

Governance and partnership

Sandström (2007) has described the implementation by FÖN of the Triple Helix network, based on a sociometric questionnaire. (The Triple Helix model is defined as a non-linear spiral model of reciprocal relationships for innovation among government, academia and business. Leydesdorff 2005) In addition, she conducted 40 interviews representative of all three groups. The network has brought together approximately 125 people who have communicated on issues regarding FÖN. The network is highly integrated, compared to similar networks, and measured in terms of frequency of contacts. Examining only the mutual contacts provides a picture of those more deeply involved. It is evident from the results that there is a core group in charge, and that members from the business community have interacted outside their own ranks less frequently.

Looking at the three Helix groups, 61 per cent is *intra*group communication, leaving 39 percent for *inter*group linkages. Sandström concludes that the Triple Helix is unbalanced. The political/administrative group, which in-

cludes the FÖN coordinator, is by far the leading partner. The links from the coordinating centre to academia are strong, and to the corporate group less so. The weakest links are between the latter and the university people, which exactly contradicts the ideal situation.

However, to interpret the patterns fully, more qualitative information is needed. Sandström is able to show how the links have varied over different phases and issues. The corporate group is efficiency oriented in its communication. The members are informed, they give their views, but they rarely have time for elaborate discussions. If they feel they are not getting value for time, they quickly drop out; or, it could be said, they give up too easily. The researchers are frustrated by the lack of constructive feedback given by the business community. Also the public sector representatives are clearly annoyed by this attitude. How time for interaction is viewed by the SME businessman, the public administrator and the researcher, clearly reflects not only cultures but also different economic conditioning.

The frustration expressed by some in the corporate group is also directed at research in a wider context. "You do whatever you want at the university. Our problem is with implementing the ideas." Others claim that the firms are alibis for the researchers, who are only interested in improving their chances for funding. Or, "I know how it works with researchers. They are not open, and many are looking for certain answers." Some more positive opinions are also expressed, e.g. one business leader says that he would not have made a certain investment had it not been for the research. It seems that one project (fish farming) will lead to concrete application by a company, but this is located in southern Sweden. Another has enjoyed the experience of interacting with the doctoral student – "much better than expected". When asked a majority say that, should there be a continuation of FÖN, then they want a stronger voice in selecting and running the projects.

Many of the supervisors we spoke to were not really negative about this. According to all the respondents who touched upon the issue of how a new research station should be organised, the way that the problems for research are defined is a very important factor. There should be two or more doctoral students per area, who collaborate with supervisors and companies. The supervisors and professors should shoulder a greater responsibility for partici-

pating in the outreaching contacts with the companies in the project. Several respondents underlined the importance of a long-term sustainable approach. It can take 10 or even 20 years to see all the real effects, according to a senior researcher.

The most important point was without doubt the importance of all the different parties seeing their own roles and limits more clearly. In the throes of enthusiasm, it is easy to step beyond the boundaries of one's own expertise. The Triple Helix model is often described as being less prone to conflict than is actually the case. There is a risk that people will jealously guard their interests and act strategically in order to increase their influence. Not least, it is important that the public representatives realize how relatively small their role is, and that the strong axis around which the Helix turns, is business *cum* academia. The political partners behind FÖN claimed a strong position. Being responsible for the budget to EU and as initiators of the whole programme, they retained considerable control throughout the project. Governance has been rather more traditional than participative.

Vaile and Ghiglione (undated) have addressed two variants of the Helix: first, the *neo-corporatist Helix*, which is focused on reaching a coordination of activities among representatives of academia, industry and government. A committee plans the structure and process, leaving less to an endogenous evolution. Second, *the evolutionary Triple Helix*, which is a normative framework with incentives to orient academic and industrial players towards a high level of integration. The government is in this case, low-keyed, helpful and mainly reacts in response to propositions from the other two pillars. FÖN, true to its corporatist origin, tried to reach a high level of convergence with rather tight management.

Summary

A tentative assessment of the effects produced by FÖN in relation to the regional innovation system is the following:

– Tighter and more extended knowledge-bearing networks.

– Access to new concepts, knowledge and useful understanding.

– Research-trained people with experience from firms and industries in the region.

– Issues pertaining to the R&D infrastructure have been introduced on the agenda.

– Few direct inputs in business that generate jobs and income.

Overall, it appears that there were unrealistic expectations, considering what experience tells us about commercial and industrial development. The percentage of positive applications can in fact be regarded as not so bad. Most experience shows that the percentage of projects successful, according to its own targets, is usually around 10 per cent, which is approximately the case for FÖN. Some would have preferred a research programme with a lower level of risk that was oriented towards general needs of most companies in the region, rather than towards product innovations. This strategically important choice was not thoroughly thought through.

A central external point of view regarding FÖN relates to how well the learning processes and the social process have been developed, rather than to whether the project was well planned or reached specific technical targets. If there is no continuation and the learning process is halted, then FÖN is a failure. If FÖN has generated sufficient interest to continue working with R&D issues, then it is a success[5]. Sandström's interviews provide support for the following ranking in order of enthusiasm for the FÖN concept *ex ante* and *ex post*:

Initial order by positive attitude:	**Final order by positive attitude:**
1. Local public administration	1. Academia
2. Business	2. Local public administration
3. Academia	3. Business

FÖN can claim credit for the fact that many in the academic group now are more committed to applied research in an IRU format, and that the politicians

[5] At present, the steering group is considering a modified continuation. A definite decision is dependent on EU funding.

are still on track and want to proceed. The issue which is outstanding is, however, what to make of the dejected experience of the majority of the business community.

The experience clarifies an important choice. Should the IRU go for broad effects on the business community, or alternatively focus on a high level of innovation and issues where it is likely that one or a few firms, e.g. fish farms, will benefit? We always need to bear in mind the harsh conditions for an innovation to become economically successful, of which R&D is a small part. It needs to be functional (to work), competitive (be better) and supported by a sufficient investment in production and marketing.

The evolutionary interpretation of the Helix model assumes that industry, universities and government stimulate economic growth through the development of loosely coupled, reciprocal and generative relationships that persist over time (Leydesdorff/Etzkowitz 1997). In the remainder of this article, this is the issue we will address.

Discussion

Common to all three IRUs are the difficulties they met trying to establish a strong generative relationship between the researchers and the business people. I argue here that applied interactive research needs to be guided by a higher awareness of the different epistemological perspectives (needs) of a theoretically and a praxis-focused search for knowledge. The remarks touch on some fundamental scientific issues. First, a distinction made by Karl Popper and others, about different stages in a research process. Second, Mode 2 analysis is useful to highlight some difficulties of communication that the IRUs encountered. Thirdly, in going from the academic to the applied perspective, the problem of verification is basically transformed.

Stages in the research process

Applied interactive research is often criticized, at least in the Nordic countries, for not being properly scientific and concerned with verification. Important distinctions which relate to this are discussed by Popper (1985) and Shotter (2003). Karl Popper speaks of the *context of discovery* and the *context of*

justification as two different situations in the research process, abiding to different norms. The former is open, creative, interactive, intuitive and playful; the latter is closed, systematic, empirical and regulated by methodology and statistical rules (Popper 1985). Academic researchers often, especially when under critical pressure, emphasise the part of the research process where they can seek refuge behind established scientific rules, and present "facts" as objectively as possible. Practitioners are in contrast often more interested in the innovative aspects and the heuristic uses of theories and empirical statements within "the context of discovery". They see their academic colleagues as too critical and defensive. The entrepreneur is often happy to replace the process of verification by "trial-and-error", which gives fewer unambiguous facts but more contextual experience and saves time.

Shotter makes an argument which also identifies an alternative program for research, when he distinguishes, similarly, between two kinds of programmes: *Classical finished science* and *Unsettled research science* (2003). "Finished sciences" are conducted wholly within a disciplinary discourse consisting of a single system of ordered statements representing changes in an idealized subject matter. During the conduct of the experiment and the making of their observations, a community of scientists must all be able to communicate in non-misleading ways about uniquely new possibilities. "Unsettled research science" cannot be conducted within a strict disciplinary discourse, says Shotter. To inquire into "possibilities not yet actualized", unsettled sciences must be conducted conversationally. This does not mean that anything goes. The "interactive moment" is crucial for everyone and must be responsive to previous utterances, be answerable to a speaker's present position, etc.

It is in the disorderly details that come to light within such inquiries that new hypotheses crystallize. Action research (as understood by Shotter) draws on the same processes of communication and interaction as those used in "unsettled research science". He invokes the concept of narrative when he describes conversations in unsettled research science. Like a strong narrative, these statements are loaded with effective instructive expressions, convincing metaphors and persuasive facts. He notes that this talk is very much like that used by managers and other participants in action research. It is important to

see that there is nothing improper about emphasising one stage before the other. When the entrepreneur is less interested in systematic verification, it may be because he/she believes that even if given time, the researcher is likely to come up with incomplete answers at this stage.

The generative relationship

A useful guide to generative relationships is Michael Gibbon's and his colleagues' Mode-2. New *praxis* relevant knowledge results from a process of co-evolution between the academic and entrepreneurial spheres. "Knowledge-in-action" is increasingly the outcome of open interchange between research and the civil society, so-called Mode-2 science. Society "speaks back to science", say Nowotny, Scott, and Gibbons (2001). An increasing number of people share in a Mode-2 culture in which science is present with arguments and perspectives, and is not the privileged field of one professional group.

Many people in Norrbotten and other economically stagnant regions are, in our experience, still holding on to a Mode-1 world. Sandström writes that practically all the politicians interviewed are convinced that there is a direct benefit of research that consists of concrete results that can be directly implemented in the activities of the companies. The problem is, according to the politicians, to get the local managers to realise this. The low level of commitment of the business community is identified by the politicians as the project's weak link (Sandström 2007). Their notion implies a linear R&D process and disregards the social action aspect that is crucial to innovation systems (Johnson/Edquist/Lundvall 2003). Our experience indicates that successful interventions are a combination of direct instrumental usefulness ("how to…"), and indirect, "learning how to learn, how to…".

Following the Mode 2 analysis, science and society have occupied each others' domains (*transgression*). Science has become crowded with a variety of norms and practices which cannot be reduced to a single privileged generic methodology. Science is also becoming transformed by *contextualization*, meaning an increased interest in the participants' experiences, interests and situation. Contextualization is a process of 'reverse communication'. A

strong sign of contextualization of research is when a prominent place is given to users in the process of producing knowledge (Nowotny et al. 2001).

Most people nowadays do not believe research alone or specialists can provide full answers to their questions. The role of the researcher is no longer that of the *savant,* but of a guide through a process of searching and sense-making, working on people's *theories of action* and mental maps (Argyris, in Smith 2001a). However, in order not to throw out the baby with the bathwater, it is important to consider the different kinds of knowledge; analytical in science, synthetic in technology, and symbolic in creativity. Research-based methods and knowledge, one way or the other, are increasingly important in all sectors; however, a key difference is that only a few industries are science-based and generate value from analytical knowledge, while most industries produce value from synthetic and creative ideas and models (Cooke/Leydesdorff 2006). In the case of IRUs, it needs to be understood that the focus is on synthetic and creative knowledge and related processes.

Robust knowledge and narratives

The concept of narrative denotes some of the same terrain as Argyris' "theory of action". It is a truism, confirmed by the IRUs, that researchers and entrepreneurs see knowledge differently. While the essence of pure science is to provide verified theory, praxis is often led by theoretically-informed hypotheses. As pointed out above, scientific statements often leave a number of relevant issues unanswered. In action the entrepreneur needs to fill in with assumptions, intuitions and unsystematic experience. In Mode 2 there are two kinds of appropriation of knowledge – *reliable scientific knowledge* and *social robust knowledge*. The first is based on validation by statistical verification, and the other by being accepted by society and used in action.

The anti-authority values of post-modern democratic society have opened many new discourses to the public. Academic theories are frequently contested for application by laymen who see the problem-terrain or context differently. Most scientific methods are related to reductionism. Science cannot validate theories for action, strictly by conventional discipline-bound norms. To be robust and practical, theories need to be contextualized and sensitive to

a wide range of social, economic and environmental implications, rather than de-contextualized and narrowed down in a controlled experiment.

The different discourses are brought together in the concept *narratives of expertise*, (much like Argyris theory-in-action and "espoused theory"). A generative research relationship must overcome scientific fragmentation by presenting strong narratives, which make findings comprehensible in a setting people accept. Such narratives transgress, in the sense that they respond both to issues which are scientific and applied. For the research-based narrative to be a strong action-frame-of-reference, it needs at some stage to go outside the fact-finding discourse to produce a psychological response. Successful implementation is supported by charismatic and creative narratives, (which also contribute to success in academia – no matter how difficult it is to acknowledge this). This fact of life raises issues, which can only be settled by a strong ethic and the integrity of the researcher.

Uncertainty

The authority of the expert, in contrast to the scientist, increases from bringing together the many heterogeneous practice-related dimensions of knowledge that are relevant. For robustness we need to integrate both what we believe we know for sure, and the relevant uncertainties. In economic decisions, the assessment of uncertainties and the calculation of risks are as important as the facts. While scientists can reduce uncertainty by theoretical specifications of the model even at the cost of realism, the entrepreneur needs more realism to be brought into the model in order to weigh the risks. A robust narrative brings realism to theory, to the satisfaction of the public.

Coping with uncertainty and unknowable implications is arguably the major challenge for the application of research. The work of IRUs should be seen in this light. The effectiveness of the process by which knowledge becomes socially robust depends on it being participative, transparent and interactive, all of which enhances a shared vision. There is a need for statistical and other methods to assess uncertainty; and, if necessary, to alert economic institutions which counter-balance risks, either by somehow eliminating them

or spreading them out through risk sharing. Working with IRUs includes examining such coping strategies for uncertainty.

Practical knowledge is produced and used in context and partly tacit. A consequence is that the sites of problem formulation move, from the institutional domain of universities and government, into a public market space in which scientific theories meet the public, and are continuously challenged and tested by competing models. Etzkowitz, famous for the Triple Helix model, claims that we are past the stage when conflicts are about whether it is right for universities to collaborate closely with business or not. Attention has turned to innovative organizations to accommodate new connections and the co-evolution of research (1998). In a small way, this is what the IRU is about.

Conclusion

With *knowledge* as the crucial element driving regional development, attention is drawn from resource endowments to learning capabilities (Johnson/ Edquist/Lundvall 2003) Economic stagnation is caused by ineffective learning capabilities, which often reflect capabilities which have been outmoded by structural change. Knowledge may indeed be viewed as the central development factor, but what matters most may not be remedies on the supply-side of knowledge but on the demand-side: The capability to find, process and put to use, knowledge. Only a minor part of learning is directly related to local R&D institutions. More important in regional development is the extent to which individuals, communities and firms learn from interacting with each other and elsewhere. In achieving this wide-spread qualitative network, IRUs have one of their highest potential for usefulness.

In FÖN we found the researchers becoming increasingly comfortable operating in a business milieu, without giving up their academic identity; while their partners in business became more understanding of the peculiar ways of the researchers. Thus, FÖN was a learning-event for all involved – politicians, business people and academics – not about learning to cultivate perch, but about learning to learn to cultivate perch. As such, we learnt a lot.

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